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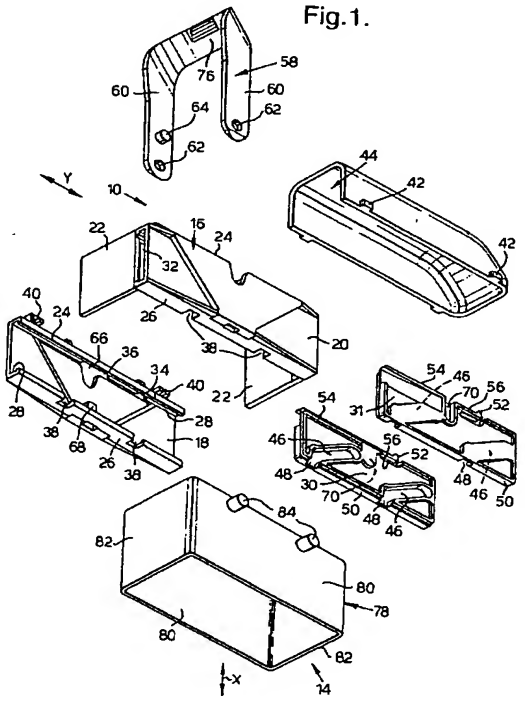
(54) Two-part electrical connector

(57) An electrical connector (10) comprising a first part (12) including a housing (16) having opposed side walls (18,20) each having an upper wall (24) and a lower wall (26) defining opposed slide surfaces (28) extending in a direction substantially perpendicular to a mating axis (X), first and second spaced apertures (34,36) in the upper wall, a pair of spaced apertures (38) in the lower wall, and a longitudinally extending slot (66) in the upper wall; a slider (30,31) positioned adjacent each side wall, each slider having an upper edge (54) and a lower edge (50) making a sliding engagement with the slide surfaces of the upper wall and the lower wall, a pair of inclined cam surfaces (46) having openings (48) in the lower edge alignable with the apertures in the lower wall, and a resilient tab (52) in the upper edge for making a snap fit in the first aperture in the upper wall in a fully unmated position, or in the second aperture in a fully mated position; a substantially U-shaped lever (58) having a pair of arms (60), each arm extending through the slot in the side wall to be positioned between the side wall and the adjacent slider; pivot means (62,68) on each arm and each side wall to allow the lever to pivot relative to the housing of the first part; and drive means (64,70) on each arm and each slider to slide each slider relative to the adjacent side wall on pivoting of the lever relative to the housing; and a second part (14) including a housing (78) having side walls (80) each having a pair of spaced cam followers (84) which can pass through the apertures in the lower walls and the openings in the inclined cam surfaces for sliding movement along the cam surfaces; pivoting movement of the lever moving the second part relative to the first part along the mating axis between the fully unmated position and the fully mated position.

Fig.1.



EP 0 938 162 A2

Description

Technical Field

[0001] The present invention relates to a two-part electrical connector in which a lever to used for mating and unmating of the two parts.

Background of the Invention

[0002] A two-part electrical connector with a lever for mating and unmating of the two parts is disclosed in EP-A-0722203. The lever is substantially U-shaped and is pivotally mounted on the housing of one part of the connector. A pair of sliders are also mounted on the same housing and slide on pivoting of the lever. The sliders have cam surfaces which engage corresponding cam followers on the housing of the other part of the connector. Pivoting of the lever causes the sliders to slide to mate or unmate the two parts of the connector. The pivot connection between the lever and the housing of the one part of the connector requires an arcuate slot in each arm of the lever.

Summary of the Invention

[0003] The object of the present invention is to provide a two-part electrical connector which is an improvement of the above mentioned arrangement.

[0004] An electrical connector in accordance with the present invention comprises a first part mateable with a second part along an axis, the first part including a housing having opposed side walls and opposed end walls, each side wall having an upper wall and a lower wall defining opposed slide surfaces extending in a direction substantially perpendicular to the mating axis, first and second spaced apertures in the upper wall of each side wall, a pair of spaced apertures in the lower wall of each side wall, and a longitudinally extending slot in the upper wall of each side wall; a slider positioned adjacent each side wall, each slider having an upper edge and a lower edge making a sliding engagement with the slide surfaces of the upper wall and the lower wall, respectively, of the side walls, a pair of inclined cam surfaces having openings in the lower edge alignable with the apertures in the lower wall of the side walls, and a resilient tab in the upper edge for making a snap fit in the first aperture or the second aperture in the upper wall of the side wall; a substantially U-shaped lever having a pair of arms, each arm extending through the slot in the side wall to be positioned between the side wall and the adjacent slider; pivot means on each arm and each side wall to allow the lever to pivot relative to the housing of the first part; and drive means on each arm and each slider to slide each slider relative to the adjacent side wall on pivoting of the lever relative to the housing of the first part; the second part including a housing having side walls and end walls positionable inside the side wall and end walls of the housing of the first part, each side wall of the housing of the second part having a pair of spaced cam followers which can pass through the apertures in the lower walls and the openings in the inclined cam surfaces for sliding movement along the cam surfaces; pivoting movement of the lever moving the second part relative to the first part along the mating axis between a fully unmated position in which the tabs on each slider make a snap fit in the first aperture in the upper walls and a fully mated position in which the tabs make a snap fit in the second aperture in the upper walls.

[0005] Relative to the above mentioned prior known arrangement, the sliders are protected by the side walls, means are provided for holding the sliders in the fully mated and fully unmated positions, and there is no requirement for an arcuate slot in each arm of the lever.

Brief Description of the Drawings

[0006] The present invention will now be described, by way of example, with reference to the accompanying drawings, in which:-

Figure 1 is an exploded view of a first embodiment of two-part electrical connector in accordance with the present invention;
Figure 2 is a perspective view of the connector of Figure 1 with the lever in the fully mated position;
Figure 3 is a similar view to that of Figure 2 of the first part of the connector with the lever in the fully unmated position;
Figure 4 is a cross-section view of a second embodiment of electrical connector in accordance with the present invention with the lever in the fully unmated position;
Figure 5 is a similar view to that of Figure 4 with the lever in the fully mated position;
Figure 6 is a cross-sectional view of one part of a third embodiment of electrical connector in accordance with the present invention with the lever in an intermediary position; and
Figure 7 is a cross-sectional view of one part of a fourth embodiment of electrical connector in accordance with the present invention with the lever in an intermediary position.

Description of the Preferred Embodiment

[0007] Referring to Figures 1 to 3, the first embodiment of two-part electrical connector 10 in accordance with the present invention comprises a first part 12 and a second part 14. Each part 12,14 is capable of receiving an retaining electrical contacts or terminals (not shown). On mating of the first and second parts 12,14, the contacts in the first part mate with, and complete an electrical connection with, the corresponding contacts in the second part. Any suitable type of contacts may be used. The first part 12 mates (mechanically and electrically

connects) or unmates (mechanically and electrically disconnects) with the second part 14 by moving the parts relative to one another in an axial direction X.

[0008] The first part 12 of the connector 10 comprises a housing 16 of electrically insulating material, which is preferably plastics material, and which is preferably moulded in one piece. The housing 16 comprises first and second side walls 18,20 and end walls 22. Each side wall 18,20 has an upper wall 24 and a lower wall 26. The upper wall 24 and the lower wall 26 of each side wall 18,20 define, internally of the housing 16, slide surfaces 28 for a slider 30,31, respectively, positioned adjacent the side wall. Each slide surface 28 extends in a direction Y which is substantially perpendicular to the mating axis X. Each slider 30,31 (which is preferably moulded in one piece from plastics material) is inserted into the housing 16 by way of slots 32 formed between the side walls 18,20 and the end walls 22. First and second spaced apertures 34,36 are formed in the upper wall 24 of each side wall 18,20, and a pair of spaced apertures 38 are formed in the lower wall 26 of each side wall. The upper wall 24 of each side wall 18,20 has latch means 40 on its outer surface which makes a snap fit with corresponding latch means 42 on a cover 44 of the first part 12 of the connector 10.

[0009] Each slider 30,31 has a pair of inclined channels 46 formed therein which open at an opening 48 through a lower edge 50 of the slider. The channels 46 are open sided and formed on the internal surface of each slider 30,31. The openings 48 in each slider 30,31 have the same spacing as the apertures 38 in the corresponding side wall 18,20, such that the openings 48 can align with the apertures. The channels 46 in each slider 30,31 are inclined in the same direction at the same angle and open inwardly towards the other slider. The channels 48 in each slider 30,31 are inclined in the same direction. A tab 52 is formed in the upper edge 54 of each slider 30,31 either on a resilient arm 56, as shown, or on a resiliently flexible beam (not shown). Each tab 52 is capable of making a snap fit in the first aperture 34 or the second aperture 36 in the upper wall 24 of the corresponding side wall 18,20. The upper edge 54 and the lower edge 50 of each slider 30,31 makes a sliding fit with the slide surface 28 of the upper wall 24 and the lower wall 26 of the corresponding side wall 18,20.

[0010] The connector 10 further comprises a substantially U-shaped lever 58. Each arm 60 of the lever 58 has an aperture 62 and a pin 64, the apertures being substantially aligned and the pins being substantially aligned. Each arm 60 passes through a longitudinally extending slot 66 in the upper wall 24 of each side wall 18,20 and the aperture 62 in each arm makes a snap fit with a corresponding pin 68 formed internally on the side wall. With this arrangement the pins 68 define a pivot axis for the lever 58 to allow the lever to pivot relative to the housing 16. The pin 64 of each arm 60 makes a sliding fit in a channel 70 formed in the corresponding slider 30,31. Each channel 70 extends in substantially the mating axis X, opens through the upper edge 54 of each slider 30,31, and is formed in the opposed side (the external side) of the slider 30,31 to the inclined channels 46. On assembly, each arm 60 of the lever 58 is therefore positioned between the sliders 30,31 and the adjacent side wall 18,20. With this arrangement, as the lever 58 pivots relative to the housing 16, the pins 64 slide in the channels 70 in the mating direction X relative to the sliders 30,31 such that the lever drives (moves) the sliders in the direction Y relative to the side walls 18,20.

[0011] The cover 44 preferably includes a resilient latch tab 72 formed in its upper surface 74 which makes a snap fit with the base portion 76 of the lever 58 when the first and second parts 12,14 are fully mated (as shown in Figure 2).

[0012] The second part 14 of the connector 10 has a housing 78 having side walls 80 and end walls 82. A pair of pins 84 is formed externally on each side wall 80. The pins 84 on each side wall 80 have the same spacing at the apertures 38 in the lower wall 26 of the corresponding side wall 18,20 of the housing 16 of the first part 12. The side walls 80 and end walls 82 of the housing 78 of the second part 14 fit inside the side walls 18,20 and end walls 22 of the housing 16 of the first part 12. During mating and unmating, the pins 84 pass through the apertures 38 and slide along the inclined channels 46 formed in the sliders 30,31 in such a manner that the pins define cam followers and the channels define cam surfaces. The apertures 38 in one side wall 18 and the corresponding pins 84 preferably have a different spacing from the apertures 38 in the other side wall 20 and the corresponding pins 84 for correct alignment and mating of the first and second parts 12,14.

[0013] Prior to mating, the lever 58 is moved to the position shown in Figure 3. In this position of the lever 58, the tabs 52 on the sliders 30,31 make a snap fit in the first apertures 34 in the upper walls 24 of the side walls 18,20 to substantially retain the sliders and the lever in this position and ensure alignment of the openings 48 in the inclined channels 46 with the apertures 38 in the lower walls 26 of the side walls. The second part 14 of the connector 10 is then moved into position for mating with the pins 84 on the housing 78 of the second part passing through the apertures 38 in the lower wall 26 of each side wall 18,20 of the housing 16 of the first part 12 and into the inclined channels 46 in the sliders 30,31. To mate the first and second parts 12,14, the lever 58 is pivoted relative to the housing 16 of the first part towards the fully mated position shown in Figure 2, to release the tabs 52 from the first apertures 34 in the upper walls 24. During this pivoting movement of the lever 58, the pins 84 on the housing 78 of the second part 14 are forced along the inclined channels 46 as the sliders 30,31 slide relative to the side walls 18,20 (along axis Y) of the housing 16 of the first part 12 to move the second part in along mating axis X relative to the first part to mate the first and second parts. When the first and

second parts 12,14 become fully mated, the tabs 52 on the sliders 30,31 makes a snap fit in the second apertures 36 in the upper walls 24 of the side walls 18,20 of the housing 16 of the first part 12 to substantially retain the first and second parts in the fully mated position. To further ensure the retention of the fully mated position of the first and second parts 12,14, the lever 58 then makes a snap fit with the tab 72 on the cover 44. To unmate the first and second parts 12,14, the lever 58 is released from the tab 72 and pivoted from the position shown in Figure 2 to the position shown in Figure 3 for reverse movement to that described above for mating of the first and second parts.

[0014] The second embodiment of electrical connector 100 shown in Figures 4 and 5 is substantially the same as the first embodiment, and like parts have been given the same reference numeral. The second embodiment differs from the first embodiment in respect of the arrangement of the pivot means between the lever 58 and the housing 16 of the first part 12, and the drive means between the lever and the sliders 30,31. In the second embodiment, the pivot means comprises a slot 86 formed in each arm 60 of the lever 58, the slots extending in a longitudinal direction along the arms, and a pin 88 formed on the side walls 18,20, and positioned in the slot. The drive means comprises a pin 90 on each arm 60 of the lever 58 which fits in a bore or aperture 92 formed in the sliders 30,31 adjacent the lower edge 50 of the sliders. With this arrangement, the lever 58 can only pivot relative to the sliders 30,31 whilst driving the sliders along the slide surfaces, whereas the lever can both pivot and have translational movement (along the longitudinal axis of the slots 86) relative to the housing 16 of the first part 12.

[0015] The third embodiment of electrical connector 200 shown in Figure 6 is substantially the same as the first embodiment, and like parts have been given the same reference numeral. The third embodiment differs from the first embodiment in respect of the arrangement of the drive means between the lever 58 and the sliders 30,31. In the second embodiment, the drive means comprises a slot 94 formed in each arm 60 of the lever 58, the slots extending in a longitudinal direction along the arms, and a pin 96 formed on the sliders 30,31, which fits in the slot. As the lever 58 pivots relative to the housing 16 of the first part 12, the pins 96 move along the slots 94 to slide the sliders 30,31 relative to the side walls 18,20.

[0016] The fourth embodiment of electrical connector 300 shown in Figure 7 is substantially the same as the first embodiment, and like parts have been given the same reference numeral. The fourth embodiment differs from the first embodiment in respect of the positioning of the pivot means and the drive means in that the positioning is reversed when compared to the first embodiment. In the fourth embodiment, the aperture 62' formed in each arm 60 of the lever 58 and the pin 68' formed on the side walls 18,20, are located nearer the base portion 76 of the lever 58 than the pin 64' on each arm, and the channel 70' in each slider 30,31 which receives the pin 68' opens through the lower edge 70 of the slider rather than the upper edge 54.

[0017] The slide surfaces 28 in the upper and lower walls 24,26, and the upper and lower edges 54,50 of the sliders 30,31 may have corresponding shoulders (not shown) to ensure correct installation of the sliders in the housing 16 of the first part 12. After installation of the sliders 30,31 through the slots 32 and into the housing 16 of the first part 12, the arms 60 of the lever 58 are pushed into the slots 66 in the upper walls 24 to make snap fits at the pivot means between the lever and the housing of the first part, and the drive means between the lever and the sliders.

[0018] The pivot means of an aperture 62 and pin 68 may be reversed with the pin on the lever 58 and the aperture in the side wall 18,20.

Claims

1. An electrical connector (10) comprising a first part (12) mateable with a second part (14) along an axis (X), the first part including a housing (16) having opposed side walls (18,20) and opposed end walls (22), each side wall having an upper wall (24) and a lower wall (26) defining opposed slide surfaces (28) extending in a direction (Y) substantially perpendicular to the mating axis, first and second spaced apertures (34,36) in the upper wall of each side wall, a pair of spaced apertures (38) in the lower wall of each side wall, and a longitudinally extending slot (66) in the upper wall of each side wall; a slider (30,31) positioned adjacent each side wall, each slider having an upper edge (54) and a lower edge (50) making a sliding engagement with the slide surfaces of the upper wall and the lower wall, respectively, of the side walls, a pair of inclined cam surfaces (46) having openings (48) in the lower edge alignable with the apertures in the lower wall of the side walls, and a resilient tab (52) in the upper edge for making a snap fit in the first aperture or the second aperture in the upper wall of the side wall; a substantially U-shaped lever (58) having a pair of arms (60), each arm extending through the slot in the side wall to be positioned between the side wall and the adjacent slider; pivot means (62,68) on each arm and each side wall to allow the lever to pivot relative to the housing of the first part; and drive means (64,70) on each arm and each slider to slide each slider relative to the adjacent side wall on pivoting of the lever relative to the housing of the first part; the second part including a housing (78) having side walls (80) and end walls (82) positionable inside the side wall and end walls of the housing of the first part, each side wall of the housing of the second part having a pair of spaced cam follow-

ers (84) which can pass through the apertures in the lower walls and the openings in the inclined cam surfaces for sliding movement along the cam surfaces; pivoting movement of the lever moving the second part relative to the first part along the mating axis between a fully unmated position in which the tabs on each slider make a snap fit in the first aperture in the upper walls and a fully mated position in which the tabs make a snap fit in the second aperture in the upper walls.

2. An electrical connector as claimed in Claim 1, wherein the cam surfaces in each slider (30,31) are defined by open-sided inclined channels (46), and the cam followers on the housing (78) of the second part (14) are defined by pins (84) formed on the side walls (80) of the housing.

3. An electrical connector as claimed in Claim 1 or Claim 2, wherein the tab (52) on the upper edge (54) of each slider (30,31) is formed on the end of a resilient arm (56) or on a resiliently flexible beam.

4. An electrical connector as claimed in any one of Claims 1 to 3, wherein slots (32) are formed in the housing (16) of the first part (12) between the end walls (22) and the side walls (18,20) for installation of the sliders (30,31) into the housing.

5. An electrical connector as claimed in any one of Claims 1 to 4, wherein the first part (12) further comprises a cover (44) which makes a snap fit on the housing (16) of the first part.

6. An electrical connector as claimed in Claim 5, wherein the cover (44) has a tab (72) in its upper surface (74) which makes a snap fit with the lever (58) when the lever is pivoted to the fully mated position.

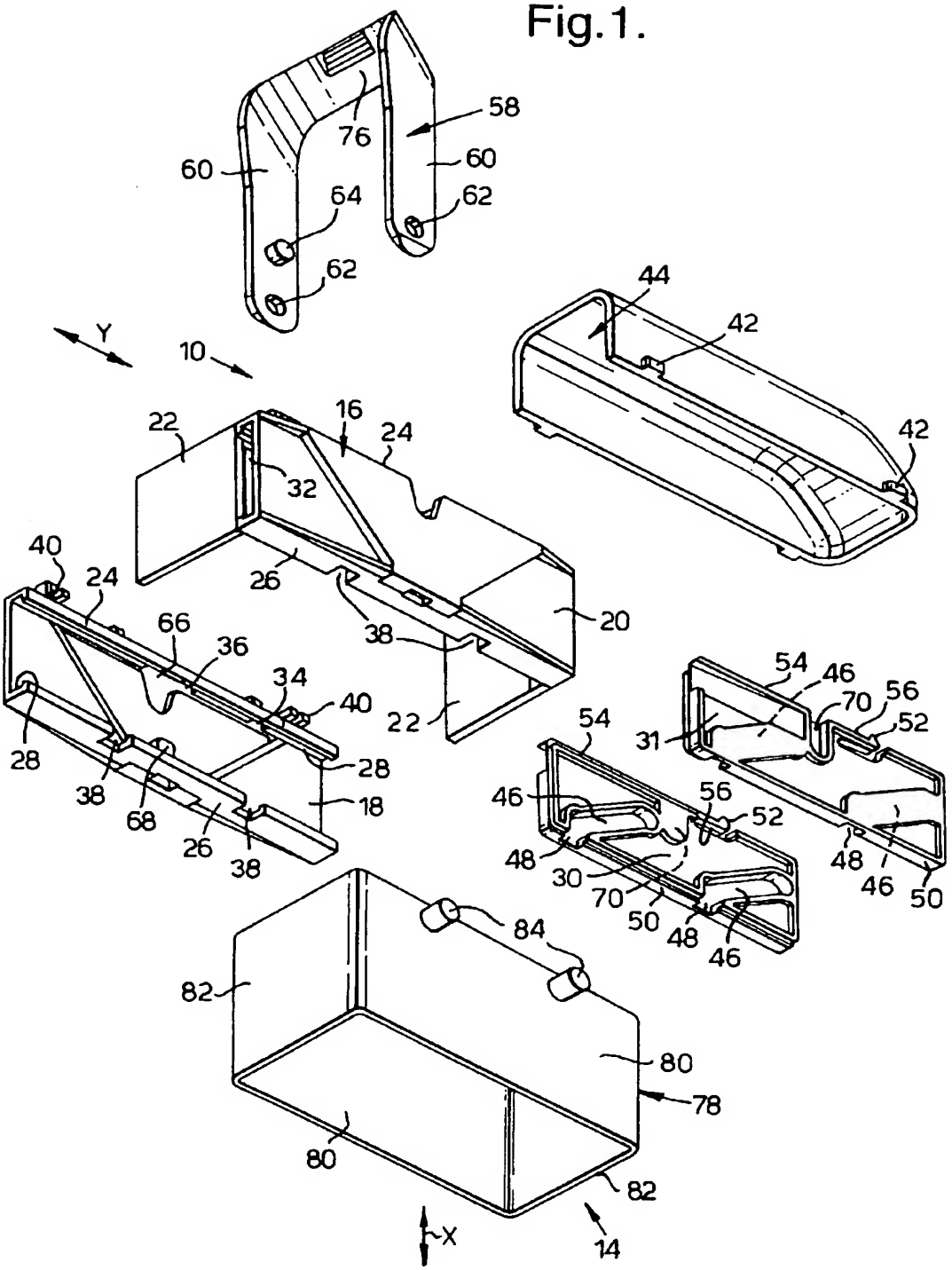
7. An electrical connector as claimed in any one of Claims 1 to 6, wherein the pivot means comprises an aperture (62) formed in each arm (60) of the lever (58) which makes a snap fit with a pin (68) formed internally on each side wall (18,20).

8. An electrical connector as claimed in any one of Claims 1 to 7, wherein the drive means comprises a pin (64) formed on each arm (60) of the lever (58) which makes a sliding fit in an external open-sided channel (70) formed in each slider (30,31), the channel extending substantially parallel with the mating axis (X).

9. An electrical connector as claimed in any one of Claims 1 to 7, wherein the drive means comprises a pin (96) formed externally on each slider (30,31) which makes a sliding fit in a longitudinally extending slot (94) formed in each arm (60) of the lever (58).

10. An electrical connector as claimed in any one of Claims 1 to 6, wherein the pivot means comprises a pin (88) formed internally on each side wall (18,20) which makes a sliding fit in a longitudinally extending slot (86) formed in each arm (60) of the lever (58); and wherein the drive means comprises a pin (90) formed on each arm of the lever which makes a snap fit in an external aperture or bore (92) formed in each slider (30,31).

Fig.1.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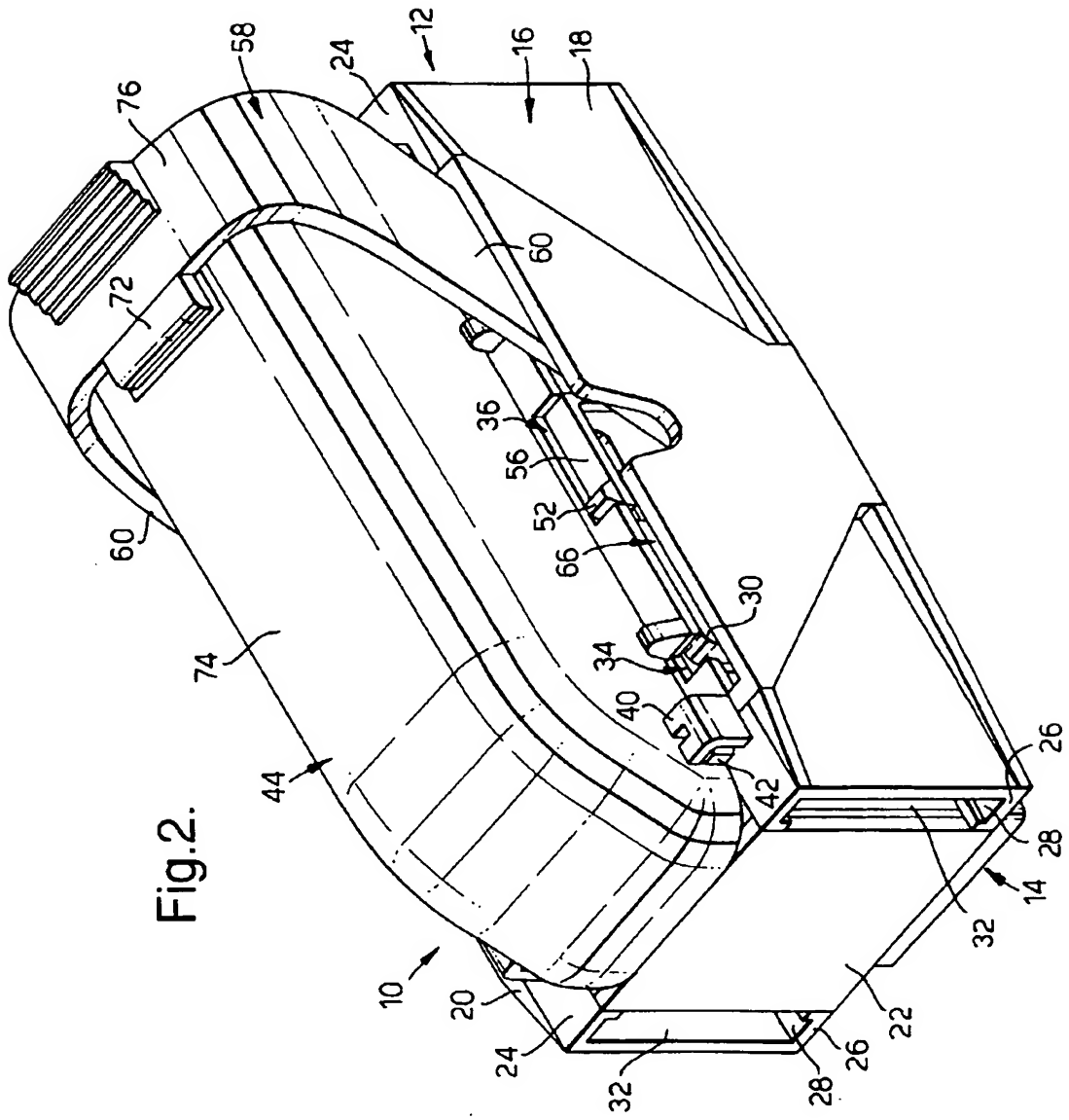
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Fig.2.

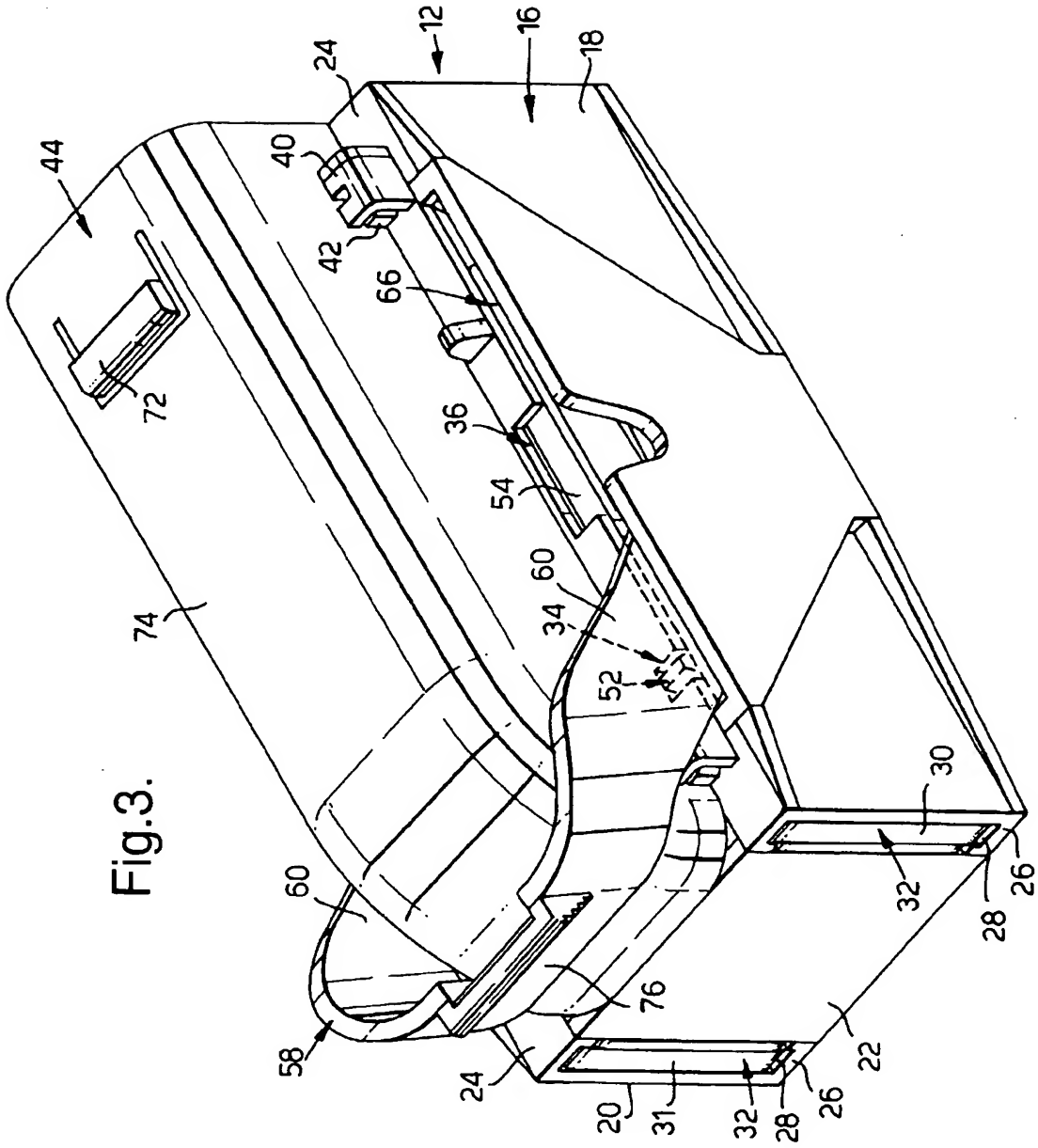
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Fig.3.

Fig.4.

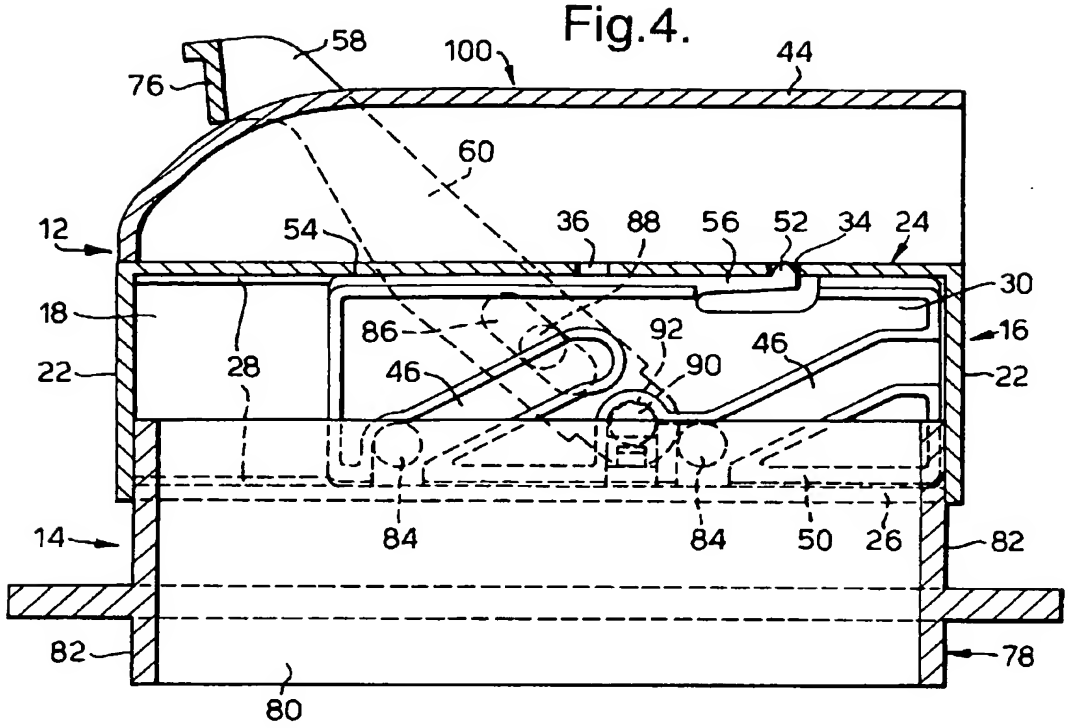
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Fig.5.

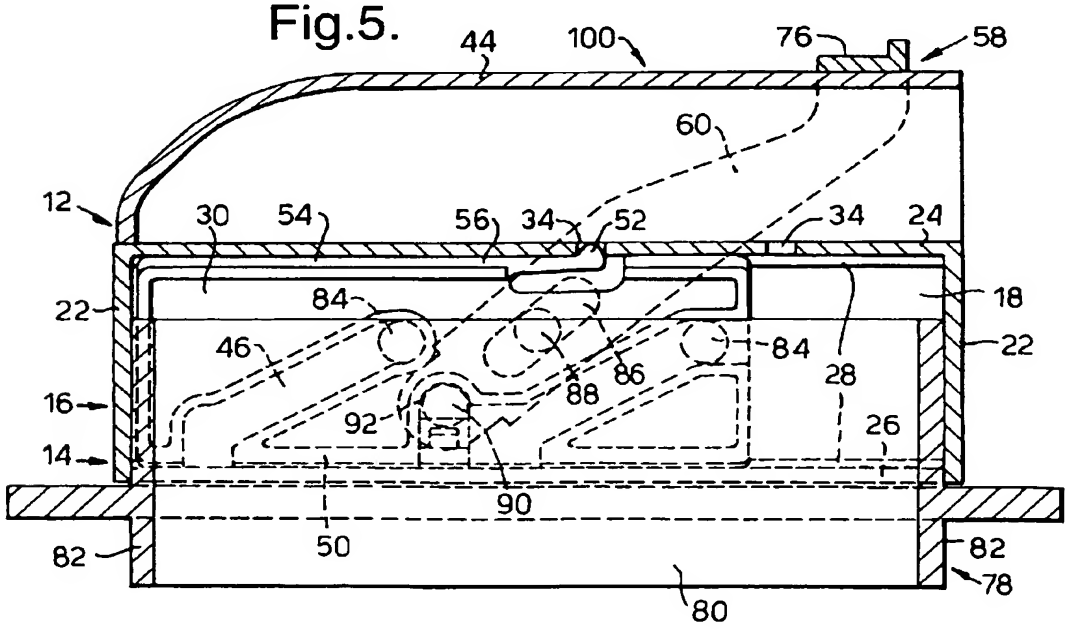
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Fig.6.

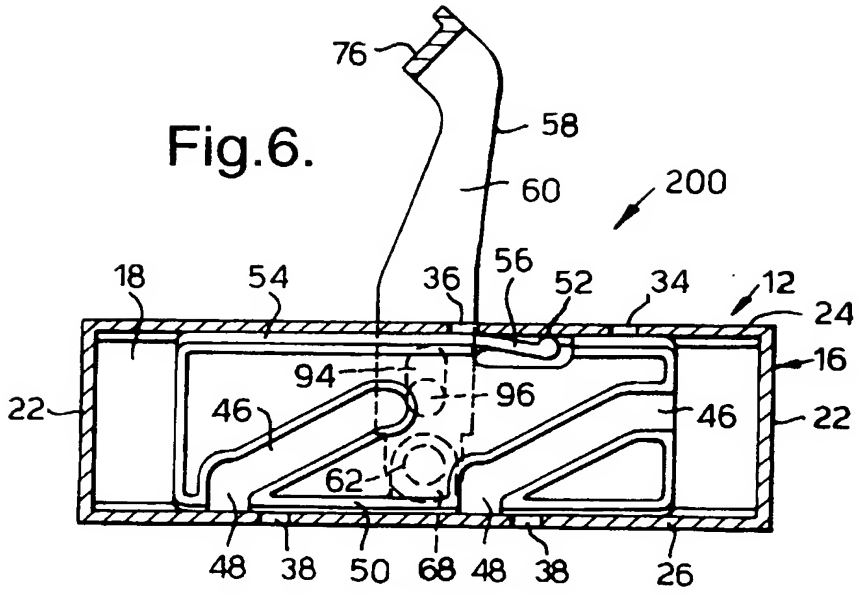
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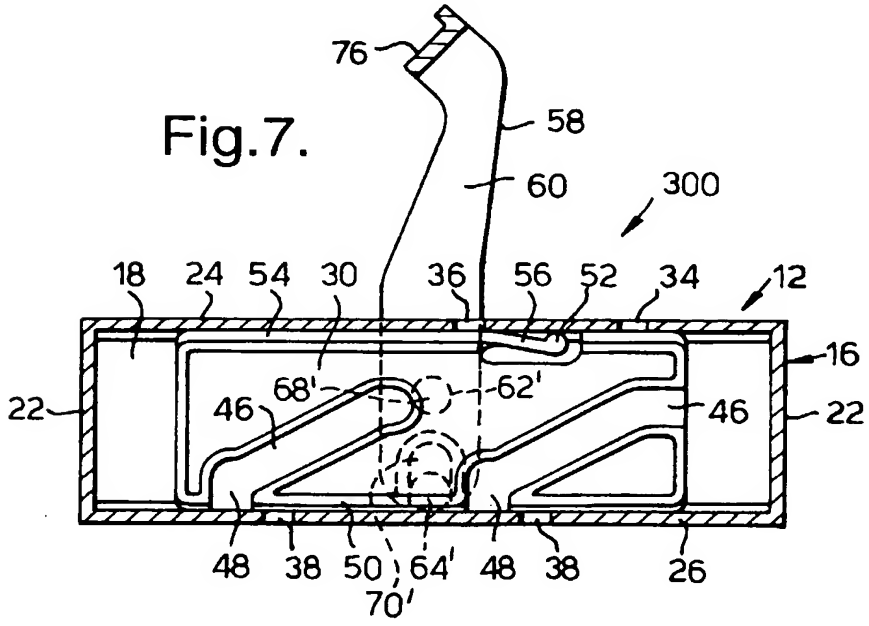
Fig.7.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